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SOME BASIC CONSIDERATIONS IN PLANNING FOR RESEARCH IN SOUTHERN PROBLEMS[1]

By Professor GEO. H. BOYD

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THERE are so many existing organizations that scientists, as well as others, have long since grown weary of the addition of more organizations with more or less duplication of purpose, more meetings to attend and more papers to be read. Every new organization which is to succeed must justify itself in terms of a distinct purpose and plan of activities. The Southern Association of Science and Industry, organized with the purpose of bringing together science and industry in the South in the effort to focus scientific research upon the problems and the resources of the South, may, I believe, be adequately justified.

This organization has had its beginning under the sponsorship and direction of persons who are prompted by a larger consideration than their own research or the industries which they represent. Recognizing the limitations under which the South is laboring and realizing the opportunities which lie here and the part which scientific research and industry may play in the development of these, they have committed themselves to the task of bringing together the research talents of scientists in this area and the resources of southern industries to contribute what they can toward the building of a greater South. This is a worthy purpose and one which has not hitherto been undertaken in a comprehensive way in the South. Scientific research is capable of making a great con-

[1] Address given before the Southern Association of Science and Industry, meeting in Atlanta, Georgia, April 2, 1942.

tribution to the progress of the South, and so direct is the relation of industry to our whole economic structure that it is particularly promising that science and industry propose to join hands in this effort. We have no thought that science and industry hold the remedies for all our ills, but we believe that the situation which prevails in the South to-day is such that the combined resources of science and industry, concentrated upon the natural resources of the South, can contribute tremendously to its progress.

Since this organization is committed to the application of scientific research to the development of the South and the solution of its problems it would not be out of place to suggest some considerations which seem to be of fundamental importance in our efforts to build for scientific research and its application to the building of the South.

My first suggestion is that our program should be one of *activity,* and not one of mere deliberation. It would seem that southerners have long ago been sufficiently informed with reference to the position of the South in the scale of progress. The South has been told that it is noted for its illiteracy, poverty and backwardness; that its intellectual resources, as well as its soil, have long since been drained to depletion; that it is a fertile field of activity for the political demagogue; that it is the nation's number one economic problem; and other such characterizations, until, no matter how true, there would seem to be little value in continuing to repeat them. No one is more conscious of the shortcomings of the South than are those southerners who are capable of understanding, and those who are not capable of understanding are likely to profit little by the repeated recitation of discouraging facts. For its improvement the South needs a program of activity such as the business man, the industrialist and the scientist can offer, provided they care to combine their efforts to that end. It seems probable that little will be gained by continued talk about the South, but a great opportunity exists for any organization which will go actively and quietly about the job of promoting constructive scientific research in the problems of the South.

It is apparent that many of the difficulties under which we labor in the South are directly related to our low regional income. As was pointed out by Odum in his "Southern Regions of the United States," the South does not have its share of the total wealth of the nation, millionaires are entirely too scarce in this area, and per capita incomes are the lowest in the nation. Many of our leaders in the fields of the social sciences are convinced that the one way out for the South is through the greater regional wealth which can best be attained through industrialization.

If our industries are to develop our natural resources, research must lead industry to these and must show how they may be developed. This responsibility upon science is a great one and one which will inevitably loom large in the minds of those who view the situation. We must not, however, focus our attention so directly upon that need as to lose sight of other considerations. If we attempt to move too directly and too rapidly toward industrial research and industrialization it seems probable that not only shall industrial research soon find itself barren and ineffective, but we shall fail in our larger motive of creating a healthier, happier and more prosperous South.

If the South is to move forward, and certainly if scientific research is to progress, the general public in the South must become more scientifically-minded and the methods of science must be more commonly followed in the attempt to solve our problems. Thomas Cary Johnson, in his "Scientific Interests in the Old South," takes the position that the "Old South" was very much the same in its attitude toward science as other sections of the country. Despite all that might be said, however, for its interest in natural history, for the popularity of so-called science courses in its colleges, and for the great scientists who may have come out of the South, the primary motive in the old South seems to have been that of broad, general culture; and at no period in its history could the South be regarded as dominated by the spirit of science. The tendency of the modern South too often is that of substituting verbal homage to the achievements of science for real support of productive effort in that field and, even then, science is commonly restricted to the gadgets which technology has produced to make life more comfortable.

It is an oft-repeated statement by scientists that the greatest thing in science is its method. The full meaning of this statement is not always comprehended and few follow this method in all their activities. Even to scientists themselves it is often more of an ideal than a method which is always followed. The statement has meaning, nevertheless, and it is a method which is just as applicable and just as essential in arriving at the truth in matters of social policy as in matters of special scientific research. This method demands that judgments be based upon facts and that judgments, therefore, be withheld until the facts are obtained. It demands freedom. In it there must be no closed doors nor information which must be withheld for the sake of policy or expediency. Its foundation stones are diligence in the quest for facts, honesty and objectivity. It can not countenance dishonesty, deceit, personal bias or looseness. It must be characterized by freedom to move into new frontiers and freedom to abandon ideas which experiment has proved to be untenable.

No human society embodies fully the scientific method, but it is doubtless true that those groups

which have embodied this method most fully are the ones that have attained the most perfect social organization. It seems unlikely that the South or any other region will ever achieve its greatest development until it is willing to abandon personal and social bias, and an unwillingness to face facts and to substitute reason for prejudice as a basis for decision and scientific method for political chicanery in public affairs. Certain it is that scientific research, pure or applied, can never progress much beyond its present state in the South until it has the support of a public which has something of the scientific spirit and method and an understanding of the achievements which its method makes possible.

The task of implanting the aim, the spirit and the method of science in the minds and the activities of the public is one of the important tasks which science and industry must face. It is one of education and one which can not be accomplished in a day. The prevailing traditions of the South which have so commonly ignored science are firmly fixed, and this task will require the greatest patience, skill and perseverance. In this task a great responsibility rests upon science in the understanding and sympathy which must characterize its efforts. Those who are devoted to the traditions of a classical culture dread the approach of science and technology because these seem to threaten the values which they have cherished. Scientists and technologists must accept a large responsibility for this fear because they have so often interpreted science with apparent disregard for human values. If the scientist hopes to be a factor in building a greater South he must never cease to recognize his obligation to the public which supports his efforts—the public which must understand him.

I have dwelt upon this question because I am convinced that, despite the practical importance which the devastation of the Civil War, the collapse of the "Cotton Kingdom" and other misfortunes may have had, the fundamental basis for the present economic and social plight of the South is to be found in large part in the southern attitude of mind, and that herein lies one of the primary tasks which science must face.

Our educational system, and particularly higher education, bears an essential relation to the development of scientific research in southern problems. For inventions and for ideas capable of direct application industry will probably turn primarily to groups of specialized research workers with whom their contacts are intimate. These groups may be located in educational institutions, but in most instances they will probably be in industrial laboratories or in institutes devoted to applied research. In order that the South may reap the greatest benefits from its natural resources it is necessary not only that the industries be located in the South but also that the research relating to those resources be carried on in the South. Furthermore, it stands to reason that the resources of the South can be best developed by those who know the South and who know those resources through close contact with them.

If institutes of applied research and the industries which look to them are to function adequately, it is practically imperative that they be backed up by a strong system of higher education which places emphasis upon scientific research and which brings its students into an acquaintance with the problems and the resources of this region. The workers in laboratories of applied research must necessarily be furnished from the science departments of colleges and universities and it is natural to expect that a majority of these should, for southern enterprises, come from southern institutions. For this reason emphasis must be placed upon the need for a strong educational system and the essential position of higher education.

The sort of scientific training which our students must have can not be provided by second-rate institutions, and it has been repeatedly shown that we have relatively few institutions in the South which could, by any stretch of imagination, be regarded as approaching the status of first-rate universities. In the past, southern colleges and universities have been very effective in the general culture which they imparted, in their training for certain non-scientific professions such as law and theology and in the quality of students which they have sent into other regions. It is doubtful, however, whether there is a single institution in the South that is giving adequate attention and support to the sciences to enable them to meet their responsibility in the development of the resources of the South and the solution of its problems.

Few people actually realize how expensive graduate work and research in the sciences must inevitably be. In attempting to build for research we must face this fact; for, if we build graduate schools only to the level of mediocrity, we shall have accomplished practically nothing. Both cost and expediency will demand that we attempt to build neither too rapidly nor too widely, but first-rate universities in the South must come, and the cost, even for the South, is not prohibitive.

Many practical problems face us in this attempt. We must be able to attract and to hold able research scholars. The oft-quoted findings of Wilson Gee ten years ago are still substantially true. The South continues to lose to other regions considerably more than it gains from them in research ability. But this is not the only menace to research in the South. In most southern institutions there is too great a tendency to draw capable research men into administrative and committee work. Nothing can be more devastating to

research. If we are to promote research, too great emphasis must not be placed upon administrative positions while too little emphasis is placed upon the activities for which the institution in reality exists. Distinguished service in the form of productive work and inspiring teaching must not be allowed to go unrecognized, but recognition must not consist in moving the able investigator or teacher out of his most effective realm and into administrative circles.

My object in these remarks has been that of pointing out a few of the more general problems which might not receive their just consideration if we hasten to focus our attention too directly and exclusively upon the application of research. I have chosen this course with full knowledge that I could say nothing new or particularly interesting. As regards the work of this association I am strongly convinced that from the beginning our course must be purposeful and our program must be one of activity. It would be my hope that every panel discussion in which we engage may be so thorough and comprehensive as to form a point of departure for some concrete course of action. I am strongly convinced, furthermore, that one of the most effective contributions which this organization may make to the progress of the South lies in the fostering of the scientific approach to problems of public concern, and that scientific research can do little more than survive in an unscientific atmosphere. If research is to progress it must have the sympathy and support which can come only when the public understands something of its aims, its problems and its possibilities. I am still further convinced that if applied research and industrialization are to make their rightful contribution to the progress of the South they must be built upon a strong educational system. The universities which train men for research constitute the foundation upon which applied research must rest.

It is my sincere belief that if this association can enlist the interest and the cooperative effort of leading scientists and industrialists in this region it may become the greatest single force in the economic and social development of the South. This organization should assume the function of keeping its hand upon the pulse of the South and of giving direction to its scientific and industrial development through the utilization of its resources. The extent to which this association succeeds in assisting in the building of the South through research will depend upon the extent to which the scientific principles of diligence in the search of facts, objectivity, open-mindedness and integrity characterize our methods. Should its efforts cease to be strictly scientific and tend to become promotional in character it will undoubtedly fail.

COLLECTIVE FARMING IN RUSSIA AND THE UKRAINE. II

By Sir JOHN RUSSELL, F.R.S.

DIRECTOR OF ROTHAMSTED EXPERIMENTAL STATION

THE results of the recent farming efforts in Russia up to the end of 1938 when the last official figures were issued have been: (1) an increase in numbers of livestock so that they had nearly reached the high levels of 1929, pigs indeed had exceeded all previous records; (2) an increase in the area of cultivated land, which fully kept pace with the increase in population; (3) marked increases in the area of fodder and of technical crops; (4) a smaller increase in area of grain crops which represented three quarters of the whole sown area. The yield of cereals per acre is still dependent largely on the season and it is not certain that any increase has occurred; comparison is rendered difficult by a change in 1933 in the method of estimating the yield; American authorities consider that the new method gives estimates about 5 per cent. higher than the old one for one and the same crop.

The grain results for the U.S.S.R. are given in Table VIII.

TABLE VIII

OUTPUT OF GRAIN, U.S.S.R.

	Population, millions	Total area sown, million ha.	Cereals sown, million ha.	Cereals produced, million tons	Yield quintals per ha.
1913	134	105	94.4	78.8	8.49
1934		131	104.7	88.0	8.54
1935		132.8	103.4	88.7	8.71
1936		133.8	102.4	81.4	8.08
1937	169	135.3	104.4	118.1	11.52
1938		136.9	102.4	93.5	9.28
Increase per cent.	27	30.4	8.5	18	

1 q. per ha. = 0.8 cwt. per acre. Biological estimates introduced in 1933. Average yield of wheat in England and Wales 18 cwt., and of oats and barley 16 cwt. per acre.

The villages themselves lack picturesque attractiveness; usually they are built along a road or sometimes round an open space, but it is always an earth road with no side walk, very muddy in wet weather and very dusty in dry. The cottages are small and very simple, made of local materials, wood in the north, wood or whitewashed adobe in the center and the Ukraine;

thatched with straw or roofed with wood or sheet iron, painted red but soon becoming reddish brown. Iron is safer from fire. In the north there is an attic or garret; elsewhere the cottages have one story only. Usually there are two rooms and a kind of entrance or large lobby, beds in each room, one room has the brick stove, in the lobby there is a cooking stove, but in the south this is often outside, it is then made of clay. Beyond a table and a few seats there is little furniture, though there may be a kind of dresser or cabinet containing some china. In the Ukraine there may be a trunk holding some of the old peasant embroidered work and shown by the old lady with great and justifiable pride. Usually an ikon hangs in a corner, which, it is explained, is for the old people; there may be a portrait of Stalin for the younger ones; a few faded personal photographs may complete the adornment. Lighting at night is sometimes a difficulty when shortage of fats and oil have curtailed supplies of candles and lamps; a pine splinter may then be used. But many villages have electric light. Usually there is no sanitation. Water is drawn from a communal well operated by a wheel and bucket; naturally this becomes a center of life and gossip. Elsewhere the cottage has its own well with a long pole as lever to lift up the bucket. In summer there are many flies, though a vigorous campaign is organized against them and on the clinics you may see a scarlet banner with the slogan, "Keep away flies: they cause decay and disease," or another, "Keep clean and so prevent disease." There are mosquitoes and various domestic insects. When you have seen a peasant woman combing a girl's hair you appreciate the force of Postyschev's demand that "hygienic baths and hairdressing shops in the villages must occupy an important part in our Party organization." Naturally one hears of dysentery, enteric, malaria and, at times, typhus, besides stomach troubles. Where there is a local hospital the doctor, often a woman, is kept very busy. The very young children often look sickly; those that grow up, however, look well and in summer they get much sunshine. There are lots of them, very friendly and accessible, very fond of being photographed. The government encourages large families and gives a bonus of 2,000 rubles for the seventh child. But it is only in the country you see them; the town dwellers, like our own, usually have small families.

The women commonly wear a dark skirt and white blouse with a white cotton square tied round the head, but the younger ones wear a printed cotton frock and a printed or embroidered square tied at the back of the head. The embroidered peasant frocks and saraphans of the old days are out of use and deemed old-fashioned. The men commonly wear tunics, trousers and peaked caps; some are bare-footed, some wear bast shoes, others canvas or leather shoes; the smart young men in the Ukraine wear white tunics with embroidered edge and the high Russian boots. All clothing, however, is of very poor quality; the clothes of my English friends were always stared at with great curiosity. One sees few old people either in villages or towns; Russia always impresses the Western visitor as a land of young people. The survival rate after 50 is not as high as in the west.

Each house is in its own piece of land, separated by a rough palisade from the road. Outside the house is the pile of fuel; always local material, it may be peat but is often straw briquettes. One sees but few flowers, although the Russians like them; there are vegetables, however, potatoes, cabbages, tomatoes and little cucumbers; these one finds and eats everywhere, and often the big watermelons. There are also poultry, one or two pigs and the cow, but usually no dog and no cat; you can travel far in Russia and meet few of either. The peasant's dietary is simple, mainly black bread, millet porridge (Kasha) and the vegetable soup known as "shchi"—made with much cabbage, some onions and other vegetables; or "borshch" made with beetroot. Sunflower oil supplies the fat, but some pork is eaten; sometimes you see tinned meat or, on the Volga, dried fish. Tomatoes and little cucumbers are much liked. Apples are the only fruit one sees as a rule; they are widely grown but not usually well grown; there is, however, good research on this subject. In the communal kitchen one often meets a compote made of fruit pulp. Tea and coffee are too dear for common use; on the Volga hot water with a piece of apple in it is often drunk. As alcoholic drink there is kvass, made from fermented black bread and when well made something like fortified ginger beer, and the universal vodka—a very potent spirit of which a good deal is consumed. One notices this in the provincial towns at night.

The administrative center of the village is the chairman's office, usually the cottage of a former kulak, built of brick and somewhat pretentiously decorated. Here one is taken on arrival at the village. Of course you can not wander about in Russia as we do here; the visit has to be arranged well beforehand, no local official can give the necessary authority and higher officials are not easily accessible. In consequence of this difficulty I could not in 1939 obtain permission to visit any grain farm in the Volga region. In the office the president and some of the committee receive us; the book-keeper is there with his abacus. On the walls are the portrait of Stalin, a print or some chart likely to interest or stimulate the village; it may be the list of yields or a diagram illustrating the different rates of work; a slow brigade represented by

a tortoise, the better brigades represented in ascending order by a donkey, a bicycle, a train, an autobus and an aeroplane. Something of the old kulak's possessions may remain; a walnut clock of Victorian design but long since stopped; a very poor picture; I have even seen a book left by the former owner, the German manager of the estate; it was a Brokhaus Lexicon, with pictures on the inside cover drawn by his children —all long since "liquidated" like himself.

Another communal building is the club-house, for the Russians are very sociable and gregarious; here there may be a library, a radio set and a gramophone. The Russians dearly love these; there are scarlet slogans advising you to listen in. The loudspeaker works almost incessantly on the Volga steamer, in the long distance trains, in the city parks and elsewhere; noise never disturbs a Russian. The accordion and balalaika still survive. Then, too, there are facilities for lectures; these in summer afternoons are in the open air, and the lecturer is sent down by the Party. There is no complication about conflicting points of view; only one Party and only one point of view. In going round an exhibition in Moscow with a few friends, one of them, a distinguished student of Russian history, was giving us some explanations in a very quiet voice, but was at once stopped by the attendant; only the official guide could explain. The Russian is eminently teachable and has great respect for teachers and especially for professors: in the villages I am always introduced as an English scientist, a specialist in soils, whose books are used in the Russian agricultural institutes; then comes the question, "Has he written anything about collective farming?" Technical books are very widely read in Russia.

The Soviet Government has done a great deal for the development of education both of children and of adults. For the small children there is always the crèche, in charge of a very kindly looking peasant woman. From 8 to 15 they go to the so-called seven-year school of which every village usually has one, or at least access to one, though the buildings may be as yet inadequate. There may be only three classrooms, one quite small. At first the instruction in the schools was related to the local industry, but that is now altered and the schools are on a uniform type of curriculum which is "cultural" not vocational. In the towns the "ten-year" school is now the standard. By 1939 the educational ladder was pretty complete and a bright child had a good chance of getting to the university; this was very different from 1930 or earlier, when only the Party ticket or proletarian birth would admit. I have known young people who could certainly have taken full advantage of a university education and knew it, but were refused; they remained always disappointed and with a bitter sense of frustration. Even by 1937 ability counted for more than birth or politics and by 1939 the change was complete. The universities were overflowing; one of the professors told me that the total number of students in the Russian universities was above 600,000, and that at the larger universities of Moscow and Leningrad there were ten applications for every vacancy. Many study science and engineering, others, especially women, study medicine or wish to become teachers. German, French and English are widely taught, yet it is most unusual to find any young people who can speak a word of any of these languages, in marked contrast with the older people of culture, many of whom spoke one or more of them with ease; the women often spoke French and the men German. I have often met German-speaking peasants, descendants of German immigrants of bygone days who, as long as they kept their old religion, kept their Biblical German language. But all that is now going and only the few specialist guides and translators can, as a rule, speak any language but their own. I asked some of my university friends why this was and received the reply: "Our education is cultural, not practical."

On the technical side the immense leeway is being made up. It is hard for us to realize what a colossal task this has been. In the old days Russian workmanship was proverbially bad. It is still often stated that the Russian is a poor mechanic, that maintenance of machinery and buildings is inadequate, that tractors and motors are not properly cared for and that many of the tractors are out of commission. But one must remember the enormous difficulties. Very few of the present generation had, as children, any mechanical toys, apart from some very ingenious wooden toys made by the peasants. Very few even now possess a bicycle, in many villages you see none and I remember once being kept waiting some ten minutes while a bicycle was fetched to show that this village really had one. There are official cars, but hardly any private cars or motor cycles and few taxis, no visible garages, nowhere where a boy can grow into the idea of machinery. In the hills of Georgia I have even met a man who assured me that until he was 21 he had never seen a wheel. Even now, children's mechanical toys are scarce and dear; there are, of course, no cheap 6d. stores, and a very poor toy may cost 3 to 12 rubles. But there has undoubtedly been an advance; the number of tractors has steadily increased to well over a half a million and there are now many tractor drivers, some 25 per cent. being women. The Red Army has been a great educational force and has presumably trained large numbers of engineers and mechanics.

The only large building in the village is the church, often a brick building in the Byzantine style, now usually converted into a club or a grain store or

partly pulled down for its bricks. It is surprising that the Russian peasant, who is always described in pre-Revolution literature as whole-heartedly religious, should apparently have dropped his religion so completely. I talked once about this with a peasant girl who had been through the famine of 1921 and seen her family die, one after the other: first the baby, then the other children and the father, then the mother and finally she herself had laid down to die but was found by a rescue party. "If you had known," she said, "how much we prayed to the saints to help us and give us food and how terrible it was when they did nothing, then you would understand why we no longer believe in them." The young Russian intellectual, of course, had always been an atheist and claimed that science had displaced religion—visitors to the Tretyakovski Collection at Moscow will remember the ribald pictures of the village priests by Perov in the 1870's. It was the intellectual who furnished the ideas adopted after the Revolution. One meets many of these people at the universities and elsewhere; their attitude is always that religion is an antiquated, rather ridiculous superstition, not accepted by enlightened people, and the Russian desire to be counted among these is such that the argument carries great weight. To my question, "If a teacher had religious convictions would he be dismissed?" the answer was "No, not if he were otherwise suitable but we should try to teach him better." This combination of ridicule and lure of "culture" (in the Russian sense) has been much more effective than persecution in the struggle against the church. Religion still survives in Russia; the ikons remain in many of the cottages, there are still churches functioning and people attending the services. Funerals may be either "white" (religious) or "red" (political) and one sees a fair proportion of "whites." I was told, though do not know personally, that many marriages are now not simply civil but religious as well. And there is a Baptist movement both in Poland and in Russia, the depth and significance of which can not be estimated. The Russian must venerate something. Watching the long queue standing for hours in the heat and the glare as they wait to pass through the Lenin tomb in the Red Square at Moscow, one gets the impression of something more than respect for a dead political leader. But it is useless to speculate about the Russian peasant—as Turgenev says: "He is like a mysterious unknown: who knows him? He does not even know himself." There is, however, no doubt about the change in moral standards. Immediately after the Revolution there was a so-called liberation from the fetters of convention that led to considerable license. Lenin strongly opposed this and the new system was found to be pernicious and unworkable. The revolt against it came from the women and gathered force as the love of sport began to develop; football, volleyball, swimming, above all, parachuting—but not yet cricket or golf. There is perhaps no better tribute to Christian morality than the fact that the Russians have come to it not out of any acceptance of Christianity but because anything else did not answer in practice.

Children no longer receive religious instruction, but they are taught to do good work and to lead moral lives. Keen young people devote their spare time to the training of the children, so that the future may be happier than the past. And the most intense patriotism is drilled into them. Stalin's stirring invocation still holds them: "The supreme law of life" for the citizen "is to love his native soil, language and people; to extol the talents, abilities and achievements of himself and his fellow citizens; to hate and reject all that does not make for the greatness of the Soviet Union, the fatherland of fatherlands."

One of the modern popular songs I heard in 1939 proclaimed that "My country is rich and large; it has fields and woods and beautiful cities, but its chief riches are its people, more free and happy than anywhere else." It is in this faith that the young Russians have been brought up and this, combined with the peasant's deeply rooted and almost fanatical attachment to the land, accounts for the superb resistance they are now putting up.

It is probably true that this war would never have arisen had there been in 1939 the same cooperation between Russia and Great Britain as exists to-day. It seems certain that the future peace of the world depends on a continuance of such friendly relations as will ensure similar cooperation whenever peace may be threatened. But friendly relations are possible only on a basis of mutual understanding and respect. We shall always differ in many ways from the Russians in our outlook and mode of life, and nothing is gained by slurring over the differences or pretending that our points of view are the same. Without giving way on any principles which we hold dear we can find much in common with the best of the Russians. Their history has been one long pageant of suffering, yet through it all has shone an intense feeling for humanity, a desire for a better and happier life for those who come after us. It is vividly shown in their literature, in Tolstoi, in Dostoevsky, in Chekhov, in Gogol—even though some of their writings emphasize the gloomy depths of the Russian character just as their ballet reveals something of its dazzling heights. "How much anxiety," says Tolstoi, "how much suffering we go through before happiness is our return!" And it constantly comes out in daily life in Russia: "Things have been bad for me," a workman once told me, "but I don't mind; they will be better for my children."

The picture of Russia I always like to remember is that of my friend Sonia among the children trying to ensure that their lives may be happier than hers has been. There surely we have a solid foundation on which fruitful Anglo-Russian friendship can be founded.

SCIENTIFIC EVENTS

DEATHS AND MEMORIALS

HENRY GRANGER KNIGHT, since 1927 chief of the Bureau of Chemistry and Soils of the U. S. Department of Agriculture, died on July 13, at the age of sixty-three years.

CAPTAIN WILLIAM JOHN PETERS, formerly chief magnetic observer of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington, died on January 10, at the age of seventy-nine years.

HENRY GERBER REIST, who retired as chief of the alternating current engineering department of the General Electric Company in 1930, died on July 5. He was eighty years old.

DR. DAVID WILLIAM CORNELIUS, professor of physics at the University of Chattanooga, Tennessee, died on June 2, at the age of fifty-seven years.

DR. WILLIAM MCCULLY JAMES, for twenty-six years chief of the Hospital of Panama and of the Herrick Clinic, died on July 10, aged sixty-two years.

CHARLES CARMICHAEL ARTHUR MONRO, assistant keeper in charge of Annelids in the zoological department of the British Museum (Natural History), died on June 21.

ACCORDING to *Nature*, it has been announced that among the Czechoslovak patriots recently executed by the Germans are a university dean and two professors, several secondary schoolmasters and a number of young men described as university students, although the universities have been closed for nearly two years. One of the professors was Professor Jaromir Šamal, formerly professor of entomology in the Prague College of Agriculture, whose work had considerable local importance through his books in Czech on the anatomy and life-history of insects, on their ecology and their economic importance. Dr. Šamal was forty-one years of age.

THE *Journal* of the American Medical Association reports that an annual W. J. and C. H. Mayo Memorial Lectureship in the field of medicine and surgery has been established at the Medical School of Dartmouth College, by Dr. and Mrs. Waltman Walters, Rochester, Minn. The memorial is established as "a stimulating factor in interesting men in medicine and surgery; particularly to call attention to the accomplishments of Drs. W. J. and C. H. Mayo in these fields."

AWARDS OF THE SOCIAL SCIENCE RESEARCH COUNCIL

SIXTY-FIVE awards, amounting to $77,700, for the academic year 1942–43, have been announced by the Social Science Research Council. The awards provide for study and research in the fields of economics; political science; sociology; statistics; political, social and economic history; cultural anthropology; social psychology; geography and related disciplines.

Ten of the awards, carrying a basic stipend of from $1,800 to $2,500 for twelve months, plus travel allowance, cover post-doctoral research training fellowships to men and women under thirty-five years of age who possess the Ph.D. degree or its equivalent. These fellowships are granted for the purpose of enlarging the research training and equipment of promising young students in social science through advanced study and field experience.

Fifteen appointments are pre-doctoral field fellowships which carry a basic stipend of $1,800 for twelve months plus travel allowance. The recipients are graduate students under thirty years of age who have completed all the requirements for the doctorate except the thesis. The purpose of these awards is to supplement formal graduate study by opportunities for field work which will assure first-hand familiarity with the data of social science in the making.

The remaining forty awards are research grants-in-aid designed to assist mature scholars in the completion of research already well under way. These grants average about $400 and do not ordinarily exceed $1,000. Nine of these appointments were made through a special fund specifically granted for the purpose of assisting and encouraging the research of social science faculties in the South. The objectives and requirements for eligibility are the same as those governing the national grants-in-aid, but applications are restricted to fourteen southern states.

RETIREMENTS AND APPOINTMENTS AT THE AMERICAN MUSEUM OF NATURAL HISTORY

A REORGANIZATION of departmental classifications in the American Museum of Natural History, with the retirement of four members of the scientific staff, was announced on July 16 by A. Perry Osborn, act-

ing president of the museum and chairman of the management board.

The retiring members are Dr. Clark Wissler, curator of anthropology; Dr. Frank M. Chapman, curator of birds; Dr. Barnum Brown, curator of vertebrate paleontology, and Dr. Willard G. Van Name, associate curator of living invertebrates. Each will continue his work with the title emeritus.

Dr. Wissler joined the staff in 1902 and was appointed curator of anthropology in 1907. Over a period of thirty years his first-hand study of Indian tribes in the western United States, particularly the Sioux, Blackfeet and Gros Ventres, has resulted in many scientific and popular publications. Under his direction the anthropological exhibitions have expanded through four floors of the museum building to include not only a collection of North American Indian materials, but also the relics of Mayan, Aztec and Inca civilizations, the artifacts of prehistoric man, and existing primitive peoples in many parts of the world. Since 1937 Dr. Wissler has served as dean of the scientific staff and has also been professor of anthropology in the Institute of Human Relations at Yale University. Dr. Harry L. Shapiro, associate curator of physical anthropology, has been appointed chairman of the department of anthropology to succeed Dr. Wissler.

When Dr. Chapman went to the museum fifty-four years ago, the bird collection consisted of only several hundred specimens, most of them on exhibition and very few available for purposes of study. Scientific expeditions were unheard of, except for those made by staff members in local areas. Through his leadership, the study collections of the Department of Birds have been increased in number to more than 750,000 specimens. The first attempt in any museum to show birds in life-like habitat settings was made by Dr. Chapman with the creation of the Cobbs Island Bird Group, at the beginning of the century. Perhaps even more important is the part he has played in awakening sentiment for the protection of wild bird life. He will continue research and exhibition work in the museum and plans to celebrate the fiftieth anniversary of the publication of his "Handbook of Birds of Eastern North America" with a new edition in 1945. Dr. Robert Cushman Murphy, formerly curator of oceanic birds, has been appointed chairman of the Department of Birds; and Dr. John T. Zimmer, formerly executive curator, becomes curator of that department.

The name of Barnum Brown is almost synonymous with those of the giant prehistoric reptiles, such as Tyrannosaurus Rex, Brontosaurus, Allosaurus and hundreds of other dinosaurs which he has recovered from burial grounds millions of years old. Excavated from the rock beds of North and South America, Asia, Africa and Europe, the bones of these fossils have been recreated in the dinosaur halls, the most complete collection of its kind in the world. Dr. Brown has led some thirty expeditions since he went to the museum in 1897. The greater part of these explorations have been in the United States and Canada and from the fossil beds of Alberta, Wyoming, Montana, Colorado, Utah, to the southern borders of Texas. With his retirement, the department of paleontology is divided into three sections. Fossil reptiles will be incorporated in the department of amphibians and reptiles, with Dr. Edwin H. Colbert as chairman and acting curator of fossil reptiles, and Dr. Charles M. Bogert as acting curator of recent amphibians and reptiles. The division of fossil mammals, with Dr. George Gaylord Simpson as curator, has been made part of the department of mammals, of which Dr. Harold E. Anthony is the chairman and curator of recent mammals. Dr. Harold E. Vokes, formerly assistant curator of fossil invertebrates, has been appointed associate curator of this branch within the department of invertebrates, headed by Dr. Roy W. Miner, chairman and curator of living invertebrates.

Dr. Willard G. Van Name, a member of the department of invertebrates since 1917, has specialized in the research of marine life, especially in the Pacific. In expeditions along the coast of California, in the Philippines and other parts of the East Indies he has made valuable collections of small sea-life. Since 1927 he has been a member of the trustees committee on conservation. His forthcoming writings will include a monograph on his extensive research of the American ascidians.

THE YALE UNIT, U. S. MILITARY HOSPITAL

THE Yale Unit, U. S. Military Hospital No. 39, including 48 physicians, 7 dentists, 103 nurses and civilian specialists, was mobilized by the U. S. Army for active war duty on July 15. The hospital unit is designed to accommodate 1,000 patients in a theater of military operations. It is a stationary hospital in the rear of a combat zone and probably will be used for foreign service. It is much larger than Mobile Hospital No. 39, which was organized by Yale in World War I, which was the first American hospital unit to land in France. This earlier surgical unit played an important role during the St. Mihiel offensive.

A message has been sent to the unit from President Charles Seymour of Yale and officials of the Yale School of Medicine, School of Nursing and the New Haven Hospital. It is as follows:

As you leave for active duty, we are anxious to extend

to you, on behalf of Yale and the New Haven community, our warm good wishes and our deep appreciation of the service which you are giving to the nation.

University and town are consecrated to that service and all our traditions demand that it should be carried on in whatever field it can be made effective. There is no field more important than that which you enter, where you will bring to the armed forces in the hour of need the science and the art of doctor and nurse. We are proud that through you Yale and the New Haven Hospital have the privilege of serving the American people.

The greeting is sent to the unit "with affection and respect" and is signed by President Seymour; Dean Francis G. Blake, of the School of Medicine; Dean Effie J. Taylor, of the School of Nursing; Harry C. Knight, of New Haven, president of the General Hospital Society of Connecticut; Thomas W. Farnam, chairman of the executive committee of the New Haven Hospital, and James A. Hamilton, director of the New Haven Hospital.

U. S. Military Hospital No. 39 will now undergo a period of training in military hospital techniques in the United States prior to engaging on actual field service. The present staff will be supplemented by 500 enlisted men, some of whom will be drawn from the New Haven area.

The bulk of the nursing personnel are either graduates from or members of the faculty of the Yale School of Nursing, or are present or former members of the New Haven Hospital nursing staff. Thirty are graduates of the Yale School of Nursing. All members of the medical personnel hold positions on the faculty of the Yale School of Medicine and the New Haven Hospital. Of this group 26 doctors are already on active duty in various Army hospitals and joined the unit at the point of mobilization. The commanding officer of the unit will be a colonel of the Army Medical Corps, designated by the War Department.

Dr. James C. Fox, Jr., clinical professor of neurology at the Yale School of Medicine, has been acting as director of the unit for the past two years during its period of organization. He now becomes chief of the medical service with the rank of lieutenant colonel. Dr. Ashley W. Oughterson, associate professor of surgery, will be chief of the surgical service with the rank of lieutenant colonel. Dr. Oughterson has been on active Army service for the past six months at various posts.

SCIENTIFIC NOTES AND NEWS

THE degree of doctor *honoris causa* has been conferred by the Catholic University of Chile on Dr. George W. Corner, director of the department of embryology of the Carnegie Institution of Washington.

THE Friedenwald Medal of the American Gastro-Enterological Association was presented on June 8 during the Atlantic City meeting to Dr. Max Einhorn, since 1896 professor of medicine at the New York Post-Graduate Medical School, Columbia University, for "outstanding achievements in the field of gastroenterology and for the invention and putting into practical use of many instruments of precision used in the study of digestive diseases."

THE Borden Prize, a gold medal and $1,000, of the American Dairy Science Association was presented to Dr. Hugo H. Sommer, professor of dairy industry at the University of Wisconsin, at the recent annual meeting of the association.

AN Associated Press dispatch states that Sir Arthur Hope, governor of Madras, decorated Sir Chandrasekhara Venkata Raman on July 16 with the medal of the Franklin Institute, Philadelphia, for "preeminent service in the scientific sphere." Sir Chandrasekhara was unable to go to America to receive the medal in person.

DR. RICHARD W. WILKINSON, Washington, on May 20 was presented with the Frank E. Gibson Award at a meeting of the Washington Medical and Surgical Society, for his "original and outstanding paper on ophthalmology." The prize is given in recognition "of meritorious contributions to medical science." It was established in 1937 in honor of Dr. Frank E. Gibson, permanent treasurer of the society.

A. GOUGE has been elected president of the British Royal Aeronautical Society for the year 1942–43. E. F. Relf, superintendent of the Aerodynamics Department, National Physical Laboratory, and Dr. H. Roxbee-Cox, deputy director of scientific research at the Ministry of Aircraft Production, have been elected vice-presidents.

THE Eastern Section of the Seismological Society of America did not hold its annual meeting this year because of the war situation. A mail ballot was held for the election of officers for the year beginning on July 1, and the following were elected: *Chairman,* Elwyn L. Perry, Williams College; *Vice-chairman,* William A. Lynch, Fordham University; *Secretary,* Florence Robertson, St. Louis University; *Treasurer,* James T. Wilson, University of Michigan; and *Fifth Member of the Executive Committee,* Ralph R. Bodle, U. S. Coast and Geodetic Survey.

AT the University of London the title of professor emeritus of anatomy in the university has been con-

ferred on Dr. J. E. S. Frazer, who resigned from the chair of anatomy at St. Mary's Hospital Medical School in March, 1940. The degree of D.Sc. has been conferred on Dr. R. V. Christie, professor of medicine at St. Bartholomew's Hospital Medical College.

DR. OSKAR WINTERSTEINER, formerly professor of biochemistry, College of Physicians and Surgeons, Columbia University, and since 1941 head of the biochemistry department of the Squibb Institute for Medical Research at New Brunswick, N. J., has been appointed honorary professor of biochemistry at Rutgers University.

DR. MARK H. INGRAHAM, since 1932 head of the department of mathematics of the University of Wisconsin, has been appointed dean of the College of Letters and Science.

GEORGE P. REA, whose resignation as president of the New York Curb Exchange became effective on June 30, has been elected president of the Drexel Institute of Technology, Philadelphia. He will take up his new work on August 1.

ACCORDING to a report in the *Times*, London, the trustees of the Lady Tata Memorial Fund announce that, on the recommendation of the Scientific Advisory Committee, they have agreed, if circumstances permit, to make the following awards for research in blood diseases, with special reference to leukemia, in the academic year beginning on October 1, 1942: Grants for research expenses—Professor J. Furth (New York); Dr. P. A. Gorer (London); Dr. A. H. T. Robb-Smith (Oxford); Professor L. Doljanski (Jerusalem); part-time personal grant for assistance, Dr. W. Jacobson (Cambridge).

DR. LON A. HAWKINS, physiologist, who has been connected for thirty-five years with the U. S. Department of Agriculture, has retired as head of the Division of Control Investigations in the Bureau of Entomology and Plant Quarantine. Curtis P. Clausen, in charge of the Division of Foreign Insect Parasite Introduction, will take over the work of the Division of Control Investigations until a successor to Dr. Hawkins is appointed.

DR. ERNEST LYMAN STEBBINS, since 1940 professor of epidemiology at the College of Physicians and Surgeons of Columbia University, who for two years previously served as Assistant Commissioner of Health of the City of New York, has been appointed to succeed Dr. John L. Rice, Commissioner of Health, who recently resigned for reasons of health. Dr. Rice will serve as special consultant to the Department of Health.

DR. LOUIS B. FLEXNER, member of the Department of Embryology of the Carnegie Institution of Washington, has been given leave of absence from the laboratory in Baltimore to serve as aide to the Committee on Aviation Medicine of the National Research Council. Dr. S. R. M. Reynolds is also on leave of absence, having been commissioned First Lieutenant in the Army Air Force and attached to the School of Aviation Medicine at Randolph Field, Texas.

DR. ERNEST M. LIGON, associate professor of psychology at Union College, Schenectady, has been appointed an expert consultant to the Secretary of War. He will lecture to personnel classes at Fort Washington, continuing his research work at Union College.

DR. J. EDWARD TODD has been appointed assistant to Harry F. Lewis, dean of the Institute of Paper Chemistry. From 1928 to 1937 he was director of admissions, secretary of personnel service and assistant professor of psychology and education at Carleton College. From 1937 to 1941, he occupied similar positions at Springfield College.

DR. HARRY E. KLEINSCHMIDT, of New York, has resigned as a member of the staff of the National Tuberculosis Association, effective at the end of the summer. He has been since 1929 director of health education.

DR. ELLIOTT CARR CUTLER, Moseley professor of surgery at the Harvard Medical School and chief surgeon at the Peter Bent Brigham Hospital, Boston, has returned to active duty with the U. S. Army after an interval of twenty-three years.

ACCORDING to the *Journal* of the American Medical Association, two members of the Subcommittee on Industrial Health and Medicine of the Health and Medical Committee—Dr. W. C. Sawyer and W. P. Yant—are now in Great Britain as representatives of the United States Government to study the industrial hygiene program in British war industries. Dr. Sawyer is a new member of the subcommittee, replacing Dr. Lloyd M. Noland, who recently resigned.

DR. EVAN CLIFFORD WILLIAMS, director of research and vice-president of the Shell Development Company, California, and for the last year vice-president and director of research of General Mills, Inc., Minneapolis, has been appointed chemical director and vice-president of the General Aniline and Film Corporation, New York, N. Y., and has been elected a member of the board of directors. From 1923 to 1928 Dr. Williams was Ramsay Memorial professor of chemical engineering at the University of London.

THE eighty-fourth annual meeting of the American Dental Association, planned to be held in Boston at the end of August, has been postponed for the dura-

tion of the war. The house delegates, standing committees and board of trustees will meet in St. Louis to transact the essential business of the association.

ANNOUNCEMENT is made by the Chicago Section of the American Chemical Society of a change in dates and location for its second National Chemical Exposition, owing to the acquisition by the United States Army of the Stevens Hotel in Chicago. The exposition and conference have been transferred to the Sherman Hotel, at Clark and Randolph Streets, and will take place from November 24 to 29 instead of a week earlier as originally planned. Adequate space will be available for an exhibit about twice as large as the first exposition sponsored by the Chicago Section in 1940.

THE Geological Society of America was represented at a conference held in Boston, in December, 1941, to consider the advisability of establishing a Commission on the Classification and Nomenclature of Rock Units. The representatives—Carl O. Dunbar, G. Marshall Kay and W. H. Twenhofel—have been continued through the present year to assist in the establishment of the permanent commission. The objects of these conferences are to bring together, under the joint auspices of the Association of American State Geologists, the American Association of Petroleum Geologists, the U. S. Geological Survey, the Geological Survey of Canada and the Geological Society of America, representatives of active American stratigraphers for debate and discussion of principles and current practices in stratigraphic nomenclature.

IT is stated in *Nature* that men of science in Great Britain now have the opportunity of exchanging scientific communications and inquiries with the U.S.S.R. through official channels. A conference was recently called at the Royal Society's rooms to discuss the development of contacts between British and Russian scientific workers. A committee was appointed to examine the possibilities, and its work has been greatly facilitated by the sympathetic attitude of the Embassy of the U.S.S.R. The following procedure has been approved by the bodies concerned. Letters addressed by individual British men of science to individual Russian men of science, or communications from British scientific and technical societies to the corresponding Russian societies, can be forwarded either to Sir John Russell, F.R.S., Ministry of Information, London, or J. G. Crowther, the British Council, London. They will take the necessary steps to forward the communications to the U.S.S.R.

THE loan fund of $5,000,000 voted by Congress to help college students speed up their training for technical and professional jobs will be available soon, according to an announcement made by Paul V. McNutt, chairman of the War Manpower Commission. Monthly loans amounting to not more than $500 a year, at 2½ per cent. interest annually and cancelled if the student is drafted during training, will be made directly to students by colleges or universities and by public or college-connected agencies. Federal funds will be allocated to the loaning institutions by the U. S. Office of Education on the submission of estimates of the amount of money for such loans. Bulletins announcing the program are being sent to all colleges and universities in the United States by the Office of Education. This financial assistance will permit students to pursue intensive programs of study which will prepare them as soon as possible to meet the growing need for technicians. Loans will be made to students in engineering, physics, chemistry, medicine, dentistry, pharmacy and veterinary medicine, who are within two years of completing their work. The program is an outgrowth of recommendations by the Office of Education Wartime Commission which conducted studies of the need of accelerated programs in colleges. Plans for administration of the student loan fund are being developed by Dr. Fred J. Kelly, chief of the Division of Higher Education, Office of Education. They will be submitted by John W. Studebaker, U. S. Commissioner of Education, to Mr. McNutt for approval.

IT is planned to issue a new series of pocket-size books entitled "The Treasury of Science" under the control of a board of editors which now includes among its members Dr. Alvin Johnson, director of the New School for Social Research; Professor Harlow Shapley, director of Harvard College Observatory, and Dr. Alfred E. Cohn, of the Rockefeller Institute for Medical Research. The object is to make available to students and to the reading public the best general statement in each science. The series will be published by the L. B. Fischer Publishing Corporation, New York City.

THE council of the Geological Society of America has approved the preparation of a directory of North American geologists patterned somewhat after the "Internationaler Geologen und Mineralogen Kalender," last printed in 1937. Names are being gathered from the membership lists of the national geological societies. For names of additional geologists it is planned to check the lists which are expected in response to an appeal, distributed with the National Roster questionnaire, for names of graduates majoring in geology since 1932. The directory will contain name, position and address, as well as a list of geo-

logical departments and institutions and their personnel.

A COLLECTION of mollusks, from waters all over the world, has been added to the department of zoology of Field Museum of Natural History. It includes more than 100,000 specimens of shells, accumulated during a period of some forty years by Walter F. Webb, of Rochester, N. Y. The collection was acquired through the interest of Stanley Field, president of the museum. According to Dr. Fritz Haas, curator of lower invertebrates, the permanent scientific value of the collection is enhanced by the fact that it includes other important private collections which Mr. Webb had purchased in Europe and America, some of them dating as far back as the eighteen-sixties.

DISCUSSION

JOINTING IN THE COAL BEDS OF OHIO

THE results obtained from a study of jointing in the coal beds of Ohio are interesting. From data secured by field work and from engineers and operators, some important facts have come to light. The jointing or cleat, as it is commonly known, shows remarkable regularity or uniformity in trend. The joints appear to follow the trend of the Appalachians to the east. The direction of the joints appear to be the same, even though more than one coal bed is involved. In Mahoning, Columbiana, Stark, Tuscarawas, Wayne, Holmes, Belmont, Jefferson, Harrison, Carroll, Guernsey and Noble counties, the joints occur in two sets commonly known as the face and the butt joints. The two systems occur at right angles to each other, one set running in a northeast-southwest direction and the other having a northwest-southeast trend. Farther south in Muskingum, Perry, Hocking, Athens and Morgan counties, one system trends in a direction a few degrees west of north and the other at right angles, has a course running a few degrees north of east or nearly east and west.

There is a variety of opinion as to the origin of the cleat in coal. One group of geologists believe that the cause is inherent in the coal itself, and that jointing is the result of contraction from the loss of gases such as methane and carbon dioxide, moisture, and the rearrangement of the carbon compounds, which has caused loss of substance. The other group are convinced that the cleat is the result of tectonic forces. The writer is inclined to follow the latter group. It is difficult to explain the remarkable uniformity in direction of the joints and the parallelism with the Appalachian folds unless we assume diastrophic movements. Moreover, shrinkage of coal, one would assume, would produce jointing in all directions.

KARL VER STEEG

COLLEGE OF WOOSTER

LABORATORY PSYCHOLOGY AND THE A.B. DEGREE

THE status of laboratory psychology in 75 prominent colleges and universities of the United States has recently been reviewed by Winter.[1] Winter's report dealt especially with the question of whether psychology was or was not included among the group of sciences which satisfy the science requirement for the A.B. degree. Of the 75 institutions listed, 13 (or 17 per cent.) had no laboratory science requirement for the A.B. degree; 18 of the remaining 62 institutions (29 per cent. of the 62) accepted psychology as satisfying the laboratory science requirement for the A.B. degree; 44 of the 62 institutions (71 per cent.) did not accept psychology to satisfy the laboratory science requirement for the A.B. degree.

Subsequent to the initial publication of these figures, a note by Courts[2] disclosed that the University of Missouri, which was classified as not accepting psychology to satisfy the science requirement for the A.B. degree, had changed its policy in 1939–40, and now accepted psychology. In view of the fact that Winter's original data were obtained in 1937, it appeared likely to the present writer that other similar changes might have occurred during the 5-year interim. On the strength of this supposition a questionnaire was sent to the 43 institutions (excepting the University of Missouri) which were originally classified as not including psychology among the sciences which satisfy the requirements for the A.B. degree. Replies were received from 42 of those to which requests were sent—a remarkably high percentage of returns. The results show several changes from the tabulation reported by Winter.

(1) Thirty-six of the 44 remain in the negative category. (We here classify the single non-responding institution along with those which voted negatively.)

(2) Three which formerly did not accept psychology to satisfy the science requirement for the A.B. degree now accept it. These three are, the University of Chicago, the University of Colorado and North Dakota University. With the University of Missouri, a total of 4 which formerly did not accept psychology to satisfy the science requirement now do so.

(3) Four of the original 44 reported special extenuating circumstances, to wit:

(a) The Massachusetts Institute of Technology gives

[1] J. E. Winter, SCIENCE, 95: 96–97, 1942.
[2] F. A. Courts, SCIENCE, 95: 275, 1942.

no A.B. degree, hence should not be listed as "not accepting" psychology to satisfy the science requirement it does not have.

(b) Similarly the University of Florida, although it gives the A.B. degree, has no science requirement in connection with that degree.

(c) At Rutgers and Vanderbilt Universities, the A.B. laboratory sciences are placed in the work of the Junior Division. Psychology is in the Senior Division, where it is accepted as a laboratory science.

These recent changes necessitate corrections in the material published by Winter. The tabulation now stands as follows:

(1) Fifteen of the original 75 institutions have no laboratory requirement for the A.B. degree. (One of these, the Massachusetts Institute of Technology, does not give the A.B. degree.)

(2) Twenty-two of the remaining 60 institutions (37 per cent.) now accept psychology to satisfy the A.B. laboratory science requirement.

(3) Thirty-six of the 60 institutions (60 per cent.) do not accept psychology to satisfy the laboratory science requirement.

(4) Two consider it too advanced for this basic requirement.

The increase from 29 to 37 per cent. acceptance in 5 years may be taken as evidence of a definite trend toward the inclusion of psychology among the laboratory sciences which satisfy the requirements for the A.B. degree.

W. N. KELLOGG

INDIANA UNIVERSITY

AN EXPANDING UNIVERSE AN INDETERMINATE PROBLEM

CERTAIN fundamentally important considerations in connection with this and other problems appear to have been overlooked or neglected in many writings and discussions of questions in ultra remote astronomy.

Nothing can possibly be known or ascertained about an object one hundred million light years distant from the earth, later than conditions as they were one hundred million years ago. It is wholly unwarrantable to assume that no material changes have taken place in that immensely long period of time and that conditions that we *observe* now are the same as those that *exist* at present. In other words, there is a complete absence of any certainty that changes which might entirely invalidate any deductions or conclusions based on this assumption have *not* taken place since the date of the latest available evidence.

For two objects distant, respectively, one hundred million and two hundred million light years from us, in the same region of the sky, we have no basis for considering their relative contemporaneous positions and other conditions except upon an assumption that no relative changes had taken place, up to one hundred million years ago, during the preceding one hundred million years. Such an assumption is manifestly quite untenable, or at least problematical.

The light-year, as the unit of measurement for great astronomical distances, is really *one yearly light mileage*. It might better be designated one Y L M.

The problem of whether the universe is "expanding" *now* or not is something like trying to determine several unknown quantities from a less number of independent equations than the number of values sought. The problem is not solvable: It is indeterminate.

JOHN MILLIS

CLEVELAND, OHIO

NICOTINIC ACID

THE reaction of the public to hastily reviewed or hastily read scientific articles, especially those relating to diets, vitamins or tumor growth, is something that deserves consideration. A good example may be pointed out in regard to nicotinic acid. The only reason for changing its name to "niacin" was because of the unfortunate linking in the lay mind of nicotinic acid and tobacco. In regard to hastily reviewed articles, one news release headlined an article dealing with the fortification of white bread by nicotinic acid—"Tobacco in Your Bread"! The lay response to this article may well be imagined.

The recent work dealing with cancer induced by the feeding of butter-yellow and modifications by specific diets is definitely newsworthy and probably headed for popularized review. I do not believe that any amount of explanation will suffice to separate "butter-yellow" from "butter" in the lay mind, and I therefore would like to enter a suggestion that steps be taken to change the name of "butter-yellow" to a form that does not have such an undesirable connotation.

JAMES R. ENRIGHT

Director, Bureau of Communicable Diseases

HONOLULU, HAWAII

BIOGRAPHY OF THE EARTH

IN my recent popular book, "Biography of the Earth" (Viking Press, 1941), representing an attempt of synthesis of to-day's astronomical, geophysical, geological and paleobiological knowledge concerning the history of our globe, I have used to a large extent the results of Professor Charles Schuchert, of Yale University, on the distribution of waters and lands in past geological epochs. In doing so I was acting under the conviction that the published results of any scientific research become an intrinsic part of science, and can be used freely for the purpose of further study or popularization. Professor Schuchert informs me, however, that in this case the situation is different, since the results collected in his paleogeographical

maps were copyrighted. In view of this fact, I am extremely sorry for having committed a mistake of using Professor Schuchert's interesting and informative results without first consulting him on that matter, and deeply apologize for hurting, though unwillingly, his feelings of ownership in that matter.

G. GAMOW
THE GEORGE WASHINGTON UNIVERSITY

SPECIAL CORRESPONDENCE

FIELD MUSEUM PALEONTOLOGICAL EXPEDITION TO HONDURAS

A PALEONTOLOGICAL expedition of Field Museum of Natural History worked in the Republic of Honduras from early November, 1941, until April, 1942. The personnel consisted of Paul O. McGrew as leader and Albert A. Potter, of the Nebraska State Teachers College, Chadron, Nebraska, as assistant. Señor Eliseo Carabantes was employed during most of the work and various other Honduran assistants were engaged from time to time.

The object of the expedition was to collect fossil mammals. Particular interest in fossils from Honduras arises from the geographic position of that country. Practically nothing is known of fossils from tropical America, and answers to several perplexing paleontological problems might be gained from study of fossils from that region. Data bearing on the accurate dating of the emergence of the Panamanian land bridge, on the dating of the Tehuantepec marine portal, on the still-existing environmental barrier between the two continents of the Western Hemisphere, on the value of homotaxis in correlation between deposits in northern and southern latitudes and on other problems might well be expected.

Three months were spent in the early Pliocene deposits of the Departamento de Gracias. These beds were worked briefly in 1937–38 by an expedition from the University of Chicago and previously reported upon.[1] Here a large collection of the dwarfed horse, *Pliohippus hondurensis,* was obtained. In addition fossils of dog, mastodon, rhinoceros, deer, camel and some reptiles were collected. All forms found were definitely of northern origin.

In the Departamento de Copan a deposit was discovered which produced an interesting and beautifully preserved collection of late Pleistocene mammals. This site was successfully quarried. Among the specimens collected were *Toxodon, Glyptodon* (?) and *Megatherium* as immigrants from South America, and *Equus, Camelops* (?) and *Felis concolor* of North American origin. Of *Megatherium* an essentially complete skeleton was obtained. The *Toxodon* is of particular interest, as it is the most northern occurrence of this group of South American mammals so far recorded. In 1886 Leidy reported a lower molar and a broken incisor from Nicaragua. Temporary conditions made it impossible to complete excavation in this Pleistocene quarry, but it is fervently hoped that in the not-too-distant future work there may be resumed.

Because of the uncertainty of water transportation, practically all the material was stored in Guatemala, where it will probably have to remain until the termination of the war. Consequently, its study and the determination of its bearing on the above-mentioned problems will necessarily be delayed. It may be stated, however, that the Pliocene fauna supports the conclusions previously reported and that the Pleistocene fauna should throw new light on our problems.

Sincere thanks are due to the government and people of Honduras, who cooperated in every possible way to make the expedition a success.

PAUL O. MCGREW
FIELD MUSEUM OF NATURAL HISTORY

QUOTATIONS

SOME SIGNIFICANT FINDINGS OF THE EXPERIMENT STATIONS IN 1941

THE preparation of the annual report to Congress by the Office of Experiment Stations on the work and expenditures of the agricultural experiment stations for the fiscal year ended June 30, 1941, has brought together the usual progress reports of the more than 3,000 federal grant projects active at the stations during that year. It is now expected that in due course these activities will be discussed in that report, but on an abbreviated basis in conformity with the national need and policy to conserve both paper and the printing funds. In the meantime the opportunity is being availed of to place on record brief statements of a few of the more significant accomplishments. These examples have been selected as representative of the subject matter fields covered in station research and the varied agricultural conditions and problems of the states and territories. They are based on statements as to the work done and the progress made under each active federal project, prepared by project leaders and made available to the office by the station directors. It needs scarcely be emphasized that they

[1] E. C. Olson and P. O. McGrew, *Bull. G.S.A.*, 52: 1219–1244, 1941.

are to be regarded as typical of the work but in no sense inclusive. The order of presentation is also largely random.

A simple low-cost plastic material from cottonseed-hull bran for the manufacture of sheaves for textile looms has been perfected by the Tennessee Station and developed in a commercial molding plant. Several hundred thousand of these sheaves already are in practical use and are demonstrating their superiority to those made of other plastics. Utilization of cottonseed-hull plastics for special purposes where strength and hardness are required promises to increase appreciably the value of a cheap by-product of the cotton-production industry.

A coumarin compound has been isolated by the Wisconsin Station from sweet clover and identified as an anti-blood-clotting factor. Selective breeding of sweet clovers of low coumarin content is now possible to obviate the disease of cattle which sometimes develops from sweet-clover feeding and may cause bleeding to death from wounds. The discovery has also been found of value in human medicine, as the new compound and others related to it may be used in treating human diseases in which it is desirable to lengthen the clotting time of the blood.

Studies by the Kansas Station on the milling and baking quality of wheat indicate that undue importance has been given to test weight in grading wheat that has been swelled by exposure to rain. When the test weight of Turkey wheat of good quality was reduced as much as 6 pounds per bushel by wetting, a degree which would have meant heavy discounts if sold commercially, milling value was affected to only a negligible extent and in most cases the baking qualities were not impaired materially.

Improvements by the New Mexico Station in pinto beans as to color, maturity and rust resistance have resulted in three new strains which have shown an increased value at average prices in New Mexico of about $2 per acre on dry land and of $11 on irrigated land. Sufficient seed was expected to be available in 1942 for the entire state.

Following studies by the Maine Station, a yield equivalent to at least 5,000 pounds of 4 per cent. milk per acre is being produced in that state with Ladino clover. This is from 1,000 to 1,500 pounds more than is usually obtained with common grassland crops on fertile soil.

Pasteurization of dill pickles shortly after the completion of the curing period was found by the North Carolina Station, in cooperation with the department, to preserve crispness of flavor long after unpasteurized pickles have become unsalable because of softening. This development is seen as a boon to dill-pickle packers, especially in the Southern states.

Failures to control red scale insects, one of the most important pests of citrus, by fumigation with hydrocyanic acid have been found by the California Station to be due to the ability of certain resistant races of these insects to close their spiracles (breathing pores) when exposed to the gas and to keep them closed for at least 30 minutes. A search is being made for substances which can be combined with hydrocyanic acid and will result in earlier opening of the spiracles.

Double-hill planting of tomatoes was found by the Utah Station, in cooperation with the department, to reduce greatly the loss of plants by beet leafhopper attacks and transmission of curly-top disease. Even under light infestation the increased yield paid for the extra plants needed. Cheesecloth covers were also effective but ordinarily too expensive.

A mixture of chloronaphthalene oil and crystal naphthalene 3:1, developed by the Massachusetts Station, gave complete control of red spider of carnations in greenhouses and was less expensive than naphthalene alone.

In a search for cheaper sources of nitrogen in animal feeding, experiments with urea, a non-protein compound in which the nitrogen generally costs only from one fourth to one third as much as its equivalent in the usual protein supplements, have been carried on in several States and Hawaii. The Wisconsin Station obtained very favorable results with urea as compared with linseed meal for dairy cows as to milk production, butterfat, protein, and vitamin C content of the milk, and the production of normal calves. In lamb feeding a lower value for urea than for linseed meal has been obtained by the New York (Cornell) Station when used as a practically exclusive source of nitrogen, but with equal parts of the two feeds the combination was only slightly less valuable than linseed meal alone.

Wide variations in fertilizer requirements of sugarcane under different environmental conditions have made economical use of fertilizers difficult of determination. The Hawaii Station, in cooperation with the Hawaiian Sugar Planters Association, has found that by sampling the sheath of the young mature leaf and determining the content of sugar, water and minerals, a very reliable guide for fertilizing and irrigating can be obtained, based on known responses on soil types under local conditions of light and temperature. Such intensive applications of fundamental scientific knowledge promises to decrease costs of production by securing sugar accumulation close to the highest level possible. This is an important contribution to the economic stability of a territory largely dependent on its efficiency in production on a little over a quarter of a million acres.

The Missouri Station has succeeded in chemically combining the proteins of skim milk with iodine to produce an artificial thyroprotein which has the physiological properties of thyroid substance. In short feeding trials, milk production of goats was increased by feeding 5 to 10 gm daily of the artificial thyroprotein, and cows which were falling off in milk production were stimulated to produce more milk by feeding 50 to 100 gm daily. This cheap source of thyroprotein may prove a practical way of increasing milk production of dairy cattle.—*Experiment Station Record.*

SCIENTIFIC BOOKS

Muscle. Vol. 3, Biological Symposia. Edited by WALLACE O. FENN. ix + 370 pp. Lancaster, Pa.: Jaques Cattell Press. 1941. $3.50.

IN the explosive, self-restituting phenomena associated with the substance myosin, muscle presents a challenge to many minds. "As a gadget which works," remarks the editor, "it has an obvious fascination for any boy or girl. It has," he adds, "a similar fascination for physiologists, the what-makes-it-go boys of biology." Augmented by additions to the initial list, the range of this symposium stretches from the rigors of bio-mathematics to the whimsies of bio-reminiscence; indeed, from the mechanics of powerful locomotor systems to that of the submicroscopic protein particle.

With rare technical skill, the Ramseys have subjected the individual muscle fiber to many crucial tests. That the functionally end-plateless fiber can be, throughout, both receiver and transmitter of excitation is strongly supported in their experiments. One of the most interesting of these reveals a singular perversity on the part of fibers permitted to shorten to 60–70 per cent. of resting length. In this "delta" state the fiber, among other changes, loses its intrinsic property to relax.

As an outgrowth from a discussion of the above studies, F. H. Pratt's historical sketch of the all-or-none concept as applied to muscle seeks its motive in Ranvier's expression, *la devise du coeur*. The type of response formulated by this "motto" is compared as a norm with deviations common to muscular behavior.

H. A. Blair analyzes mathematically the alternative features of the excitatory process: a threshold quantity of local change, and a phase of subsidence when that change falls short of threshold value. It is evident that the field is charted by the strength-duration curve. The conditions are treated with reference to selected models, of which the single polarizable membrane is found to be as adequate as the double. Dr. Street collaborates in the ingenious experiments on single fibers.

The behavior of smooth muscle is traditionally capricious. Can it be harmonized with the stereotyped capacity of skeletal and heart muscle to discharge discrete impulses and to conduct them in all-or-none fashion with a concomitant action potential? E. Bozler makes the distinction between the "multi-unit" type of smooth muscle, dependent upon outside innervation, and the automatic "visceral" (syncytial) type. Their potentials are interpreted respectively as (1) bursts of impulses referable to the discharge of discrete motor units; (2) repetitive impulses accompanying syncytial conduction. The rat's ureter presents a special case, with potential-complex typically cardiac.

A. S. Gilson, Jr., assuming protoplasmic continuity in smooth muscle, suggests that lack of uniformity in size of bridges may explain the electrical irregularities; and suggests that repetitive activity of one cell might simulate the responses of a group.

It is pointed out by A. Rosenblueth that smooth muscle is conductively heterogeneous. Long fibers, striated or smooth, show much the same type of conduction—an all-or-none effect, with potential ahead of contraction. As in Bozler's experiments, the same may be true of the short, presumably syncytial uterine muscle during estrus. Nictitating membrane and pilomotors fail to share the conductive function: here the diffusion of a chemical mediator can be invoked to explain nervous control of relatively distant cells.

The nerve-muscle junction is examined by T. P. Feng, chiefly in the light of Wedensky inhibition. Numerous important sub-topics conclude with "Local Potentials in Non-curarized Muscle." These, in summating, resemble those in completely curarized muscle, although probably not strictly localized to the end-plate. The many data analyzed lead to the following via media:

> If the spike potential and the liberation of AC [acetylcholine] in the nerve endings are intimately coupled concomitant events, the least arbitrary view at present is perhaps that which allows the actions of AC and of the spike to be mutually reinforcing, forming together an exciting complex which might even include other elements, *e.g.*, potassium ions.

In surveying the past decade of work on action potentials, A. C. Young deals first with investigations extending the membrane theory. The speeding of propagation by rise of temperature and by stretching is cited in its contributory relations. The after-poten-

tial as connected with the chemical changes is also considered, with emphasis on its temporal relation to a tension development so variable as to necessitate a separation into types. In rejecting "the conclusion that the action potential is due mainly to electrical changes at the end plate," the author voices his adherence to the intrenched theory.

In the article by Dugald Brown we witness an attack upon the redoubt that guards the secret passage between the chemistry and the mechanics of contraction —"the link between the chemical cycle and the shortening in the myosin linkages." It is possible only to note the main concept emerging from this penetrating study:

> We may suppose that at rest the active linkages are maintained in the resting state by a chemical system, some component of which is built into the linkage. In terms of a chemical system, this may well be a phosphoric ester. On stimulation, it is supposed that the linkages are activated, and that energy liberation ensues.

It is easy to think of muscle as acting universally by direct exercise of tension. But we are reminded by H. Elftman that in the great phylum of arthropods and the subphylum of vertebrates, where pivoted levers are "standard equipment," the somatic musculature employs a rotational system compelling the recognition of *torque,* of which tension is but one component. The oscillatory nature of bodily movement involves initial tension of the stretched muscle, and falling tension with rising speed. The author's analyses of torque-values in locomotion are based largely upon his own work in this reclaimed field.

In further aid to the concept that begins with the chemo-mechanics of the protein chain, and ends with torque, we are introduced by Ernst Fischer to the fascinations of dynamic crystallography. X-ray diffraction permits assumption of a three-dimensional, intramicellar, molecular lattice-work, the "repeat" pattern of which is prototype to the rhythms of microscopic structure.

F. O. Schmitt, agreeing with Dr. Fischer's view that the molecular changes educed "may still be far away from the conditions realized in nature," warns against too strict interpretation of form-birefringence data, and notes the modern substitution (for the concept of Naegeli) of an intermicellar lattice in what would correspond to Fischer's second-order pattern, intermediate between the microscopic and the molecular-crystalline.

The broad evidence from respiratory metabolism that food-stuffs are "burned" in the body favored the earlier concept of an internal-combustion engine. The peril of such analogy is long since realized. In Dr. Meyerhof's welcome contribution—the only one from Europe—oxidative factors are examined in the light of their history. The upshot of the author's analysis is his adherence to the "classical" view, in appraisal of work based upon the opportunely slow reactivity of cold-blooded muscle, and supported in the face of newly threatening revolution by the results (1940) of D. K. Hill. Agreement between the course of oxidative restitution heat and the determined assumption of oxygen is cited in affirmation of "the anaerobic nature of the fundamental process of contraction."

The general physiology of muscle—a discipline still in its inception—to an important extent owes its retardation to the unorganized state of comparative histology; and it is well to remember the diversity of conductive and contractile mechanism lying outside our own numerically insignificant group. Consider that our fellow chordates, the tunicates, outpoint the Mammalia in number of species by perhaps 50 per cent. Mysteries there are in C. A. G. Wiersma's account of what lurks within the exoskeleton of the arthropod legion: a single nerve fiber that actuates a whole muscle to quick contraction; another that is "slow" in its effect; another that inhibits; on each muscle fiber a dense feltwork of terminals like the stops to an elaborately keyed flute!

Medically, muscle has long failed of intrinsic interest. Save as indicator of nervous derangement, muscle, like consciousness, was left to take care of itself, if in so saying we ignore the debt it owes to the surgeon's hand. But the debt is reciprocal; and the thought that muscles not only keep us warm, but move the governing levers of the world's work and implement man's subtlest emotion, should be not without its share of inspiration.

Seldom have results of apparently pure academic interest had a speedier application to medicine than those recently derived from the chemistry of muscle and of neuromuscular transmission. Drs. Gammon, Harvey and Masland review the mechanisms involved in myasthenia gravis, myotonia and allied states. The reversible contributory relation between pathology and therapeutics, on the one hand, and physiology, on the other, is vividly illustrated.

The sensitivity of electrolyte balance and distribution to muscular behavior, conditioned as it is by the properties of the plasma membrane, admits of highly exact treatment; and in R. B. Dean's mathematical study, where unexplained facts must be faced, the operation of a mechanism for doing work upon the system is postulated in order to "pump out the sodium or, what is equivalent, pump in the potassium" against obstacles imposed by the equilibria of classical theory.

The issue between those who ascribe neuromuscular transmission to chemical means and those whose choice of transmitter is electrical, is not sharply drawn in this series: as already noted, Dr. Feng has offered a

via media to the pilgrim. But our concluding contribution is from the frankly "electragonist" camp, where Drs. Eccles, Katz and Kuffler analyze the potentials peculiar to the neuromuscular junctional region with the aid of modifications imposed by curare, eserine and the ingenious use of the muscle impulse itself, back-fired against the junction. The conclusion is significant that endplate effects are depolarization effects, and so germane to the classical excitation process.

The Protean physiology of muscle can provide in this single volume hardly more than a sample antebellum cross-section. Yet to secure it can have been no light task. The succinct treatment of the parts minimizes the lack of an index; and the format, uniform with other numbers, continues the tradition of a finely wrought series.

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REPORTS

SECOND REPORT OF THE WAR POLICY COMMITTEE OF THE AMERICAN INSTITUTE OF PHYSICS[1]

REVIEW OF FIRST REPORT

IN its first report[2] issued on May 1, the War Policy Committee of the American Institute of Physics explained the reasons for its existence and discussed matters of policy of concern to physicists as follows:

(1) Professional status of physicists—definitions of "physicist" and "professional physicist."

(2) Training in physics for the war—its strategic importance.

(3) Emphasis on the study of physics—as justified by war and post-war needs of the nation.

(4) Special training of physicists—required for the war.

(5) Use of physicists—the importance of making full and efficient use of trained men in physics.

FURTHER REPORT ON MANPOWER

Since publication of the first report, the War Policy Committee has devoted special attention to the national manpower situation in physics. The situation has the proportions of a national emergency and is, the committee believes, coming to be recognized as such by the Army, the Navy and the War Manpower Commission. The emergency may be stated as follows:

(1) The design, production, operation and maintenance of new physical instruments of warfare are essential to the successful prosecution of this war. (Examples: submarine and aircraft location, improvement of anti-aircraft fire, automatic fuses, signaling devices, magnetic mines, etc.)

(2) The need for more physicists for these purposes is large and urgent.

(3) The number of physicists in this country is small, only about 7,000, and a substantial portion of these are already engaged in direct war work, leaving much too few to provide physics training for Army and Navy personnel and those needed for war research and production.

(4) Training of physicists is not an easy or short-time process.

(5) Unless prompt, effective measures are taken the shortage of physicists will be disastrously acute and no adequate program for training new physicists can be effected.

To meet this emergency the committee urges the Army, the Navy and the War Manpower Commission to take the following steps:

(1) Arrange for teacher training to provide for the very great amount of physics teaching which will be needed, not only in producing physicists, but in connection with training programs of the Army and Navy in which it is essential to convey some knowledge of physics to over 200,000 men and women within a year.

(2) Revise the situation of physicists with respect to Selective Service so as to assure students and teachers of physics the possibility of continuing their work without uncertainty.

(3) Provide loans, scholarships or other assistance to well-qualified students who need aid to continue their training in physics.

(4) Any men in the Army and Navy with physics training who are not actually employing that training in their work should be transferred to positions where physicists are now urgently needed either by detail or discharge.

(5) Start a public relations program as to the meaning of physics and its importance in the war, this being necessary to secure public approval and understanding of the necessity of the preceding four steps.

TEACHING LOAD 1942–43

The committee has studied plans of the Army and the Navy to enlist a large fraction of next year's college and university students in training programs to be carried on at the institutions. The programs include the Army Enlisted Reserve and the Navy V-1 program. The services rely on these programs to provide large pools of officer material and can be expected to make every effort to recruit them to the necessarily large enrolments to meet the essential

[1] July 19, 1942.
[2] SCIENCE, May 15, p. 508.

needs. The Navy program requires a substantial course in physics; the Army program is such as to increase above normal the number of students electing physics. On the basis of joint announcements of the services and conferences with their representatives, the committee has estimated that the teaching load in college grade physics will in 1942–43 be from two to three times the highest ever before sustained. This teaching load will fall on faculties necessarily depleted for war research and, in some instances, wastefully dissipated through the direct action or indirect influence of the Selective Service Act and the lack of knowledge in some local boards as to the importance of physics and its wartime role.

The committee welcomes the very specific directives which have been issued by Selective Service Headquarters, but urges that high officials of the Army and Navy issue statements emphasizing the necessity for students and teachers to continue their present work and affirm that in so doing the individuals concerned are performing the highest and most patriotic duty open to them. Such public statements, as well as occupational deferment policies, should particularly include graduate students, since these students are already contributing heavily to the teaching of physics and are being drawn more and more into war research.

Whatever actions may be taken by federal authorities (and some are known to be in preparation) designed to lessen the prospective shortage of teachers, the committee is convinced that they can not be wholly adequate. The committee, therefore, urges college and university administrations and faculties to use every expedient they can devise to prepare for the coming flood of enrolments in physics courses. This advice is all the more urgent in view of the fact that the war research programs must continue to expand and that additional faculty members will have to be called away from their teaching duties.

SPECIAL ARTICLES

RELATIONSHIPS OF THE HIGHER ARSENIDES OF COBALT, NICKEL AND IRON OCCURRING IN NATURE

THE interrelations of the higher arsenides of cobalt, nickel and iron has long constituted a mineralogical problem. An extended series of studies has been conducted in an attempt to arrive at a better understanding of this group. In this investigation minerals from numerous localities have been examined microscopically and by means of x-rays, and as many as possible of the compounds have been produced synthetically. Some time will necessarily elapse before a complete report is published. In the meantime, it is hoped that this brief account may provide a useful outline.

Previous attempts at synthesis reveal few claims to the production of the higher arsenides of these metals. Many of the conclusions reached are also in doubt, since the experiments were carried on more than a quarter century ago, and the materials produced were identified without the aid of either the reflecting microscope or x-ray diffraction. In the absence of such methods it was neither possible to establish the homogeneity of the product nor to identify the phases obtained.

The present investigation has been carried on in the mineralogical and x-ray diffraction laboratories of the Department of Geology at Columbia University. The author takes pleasure in expressing his sincere appreciation for the unfailing encouragement, advice and helpful criticism of Professor Paul F. Kerr, of this institution, at whose suggestion the investigation was undertaken. The method of synthesis employed throughout has been that of dry fusion. X-ray powder diffraction methods utilizing both Debye and Bohlin-Phragmen cameras with iron radiation have been employed in the determination of the homogeneity of the product, in the identification of the phases present and in the correlation of the synthetic and natural material. The x-ray data have been confirmed in many cases by the use of the reflecting microscope.

Orthorhombic Arsenides RAs_2

Safflorite	Rammelsbergite
Löllingite	Pararammelsbergite

Synthetic equivalents of rammelsbergite, pararammelsbergite and löllingite have been for the first time identified with the natural minerals by means of x-ray diffraction. The synthesis of "safflorite" was unsuccessful except when iron was employed in addition to cobalt, this cobalt-iron material giving a diffraction pattern of the safflorite type. Patterns of natural safflorite and the synthetic cobalt-iron compound are similar to those of löllingite. Furthermore, no orthorhombic diarsenide of pure cobalt has been reported in nature nor has it at any time been prepared synthetically. All analyses of the mineral safflorite are high in iron. Safflorite should be redefined as a cobaltiferous löllingite and has doubtful merit as an independent species.

Isometric Arsenides

RAs_2	RAs_3
(*Smaltite)	Skutterudite
(*Chloanthite)	Nickel Skutterudite
(*Arsenoferrite)	Iron Skutterudite

*(Discredited)

Although many published analyses of these minerals roughly approximate the composition $R:As_2$ others vary widely in arsenic content, indicating a range from approximately $R:As$ to $R:As_3$. The assumption of the existence of two distinct series, one of diarsenides of cobalt, nickel and iron, respectively (smaltite-chloanthite-arsenoferrite), the other of triarsenides (skutterudite-nickel skutterudite-iron skutterudite) is a consequence of this variability in metal-arsenic ratio. Since few specimens have approached the $R:As_3$ ratio, some mineralogists have considered the diarsenides to constitute the only valid group and have looked upon the skutterudites as arsenic rich varieties of the diarsenides. Another feature which must be considered in any discussion of the interrelations of these minerals is the extensive isomorphous substitution among the three metallic elements, a phenomenon that has long been recognized.

Oftedahl established the crystal structure of skutterudite employing the assumption that the formula was $R:As_3$ and demonstrated that the x-ray data could be reconciled with this composition, but was in no way compatible with a composition $R:As_2$. However, he left unanswered the explanation of the anomalous situation in which it appears that diarsenides and triarsenides of the same metals possess identical crystal structures. He also offered no satisfactory evidence to explain the variation in lattice constants shown by the natural isometric arsenides or the variable arsenic content indicated by the published analyses. The present investigation has had as one of its primary purposes the clarification of this situation.

Study of the naturally occurring isometric arsenides coupled with experiments in synthesis suggests that the so-called isometric diarsenides smaltite-chloanthite-arsenoferrite should be discredited as valid mineral species and the name skutterudite should be substituted for the entire group of isometric arsenides of cobalt, nickel and iron. This appears to be the only satisfactory solution of the apparently anomalous situation in which diarsenides and triarsenides of the same metals possess the same crystal structure. The variations in lattice constants and arsenic content shown by the natural arsenides may be satisfactorily accounted for under this revised view of the relationships of these minerals. The reasons for the above conclusions may be enumerated as follows:

(1) Published analyses of these minerals only approximate the theoretical metal-arsenic ratio $R:As_2$ and exhibit wide divergence in both directions approaching $R:As$ and $R:As_3$.

(2) The majority of published analyses were made many years ago and are of questionable reliability, since neither microscopic nor x-ray methods were employed in establishing the homogeneity of the analyzed material.

(3) Oftedahl, using only one specimen each of smaltite and chloanthite, established the essential identity of structure of these minerals with that of the triarsenide skutterudite. This has been amply confirmed in the present investigation employing many specimens of so-called diarsenides from a large number of localities.

(4) Furthermore, it was established by Oftedahl that the x-ray diffraction data provided by the natural arsenides of these metals is only compatible with the composition $R:As_3$ and can not be reconciled with a composition $R:As_2$.

(5) Cobalt triarsenide and a series of triarsenides isomorphous with it containing varying amounts of the metals cobalt, nickel and iron have been successfully synthesized in the course of the present investigation, whereas attempts to synthesize isometric diarsenides of these metals have been unsuccessful.

(6) The natural isometric arsenides exhibit a variation in lattice constants which is of approximately the same range as that shown by the synthetic isometric arsenides. Since the variation in lattice constants of these synthetic compounds is dependent on mutual substitution among the three metallic elements cobalt, nickel and iron, it seems likely that the same may be true in the case of the natural minerals. Previous suggestions of others that the substitution of metal for arsenic may account for this phenomenon are not supported by the present investigation.

(7) Microscopic examination of many specimens of smaltite and chloanthite demonstrates that the low and variable arsenic content of the so-called diarsenides can be accounted for, in many cases at least, on the basis of mechanically admixed lower arsenides. Wide-spread lack of homogeneity is evident. Niccolite, rammelsbergite and other lower arsenides frequently appear within apparently homogeneous crystals of the isometric arsenides. No evidence of metal for arsenic substitution was observed among the synthetics although the subject has not been exhaustively investigated. Even should it be established that metal for arsenic substitution exists in certain cases, the fundamental basis for the recognition of the so-called diarsenides as valid species is not strengthened, since they possess a crystal structure shown by Oftedahl to be compatible only with the composition $R:As_3$. In the former case they would be impure skutterudites, in the latter arsenic poor skutterudites but skutterudites they remain.

The present classification, theoretical compositions

and crystal systems of the principal naturally occurring higher arsenides of these metals and a revised classification based in part on the results of these experiments in synthesis are shown below.

Previous Classification	*Composition*
Orthorhombic Arsenides	
Safflorite	$CoAs_2$
Rammelsbergite	$NiAs_2$
Pararammelsbergite	$NiAs_2$
Löllingite	$FeAs_2$
Isometric Arsenides	
Diarsenides	
Smaltite	$CoAs_2$
Chloanthite	$NiAs_2$
Arsenoferrite	$FeAs_2$
Triarsenides	
Skutterudite	$CoAs_3$
Nickel-skutterudite	$NiAs_3$
Iron-skutterudite	$FeAs_3$

Revised Classification	*Composition*
Orthorhombic Arsenides	
*Cobalt-löllingite (Safflorite)	$(CoFe)As_2$
Rammelsbergite	$NiAs_2$
Pararammelsbergite	$NiAs_2$
Löllingite	$FeAs_2$
Isometric Arsenides	
Diarsenides (Discredited)	
Smaltite (Identical with skutterudite)	
Chloanthite (Identical with nickel-skutterudite)	
Arsenoferrite (Identical with iron-skutterudite)	
Triarsenides	
Skutterudite	$CoAs_3$
*Nickel-skutterudite	$(CoNi)As_3$
*Iron-skutterudite	$(CoFe)As_3$

* Indicates pure mono-metallic end member neither satisfactorily established as occurring in nature nor produced synthetically.

For the first time the existence of the orthorhombic minerals rammelsbergite, pararammelsbergite and löllingite as arsenides of the pure metals has been confirmed by the results of synthesis and x-ray studies. Consideration of the data for both natural and synthetic "safflorite" provides no evidence of the existence of a pure orthorhombic cobalt diarsenide and suggests that this mineral might be considered a cobaltiferous löllingite rather than an independent species.

In view of the previous discussion it would seem that the names smaltite, chloanthite and arsenoferrite, which have long been applied to minerals accepted as isometric diarsenides of the elements cobalt, nickel and iron, respectively, no longer serve any useful purpose. In fact, their retention in the literature tends to confuse our view of the relationships of the isometric arsenides of these metals, all of which are apparently structurally triarsenides whether or not they can be shown to possess the exact chemical composition demanded by the $R : As_3$ ratio.

Furthermore, it would seem that the name skutterudite should be applied to the entire group of isometric arsenides of cobalt, nickel and iron, since the cobalt triarsenide is the most firmly established of all the isometric arsenides of these metals. In the course of the present investigation it has been synthesized and the identity of the synthetic product and the natural mineral skutterudite established for the first time. The same investigation has established the existence of a three-fold isomorphous series of isometric triarsenides ($CoAs_3$-$NiAs_3$-$FeAs_3$) in which the elements cobalt, nickel and iron substitute for each other in various proportions. The nickel and iron end members of this series have not been synthesized; neither has their existence in nature been satisfactorily established. The precise limits of substitution of the three metals in the series are yet to be determined. Inasmuch as pure nickel and pure iron end members are missing there is little justification for assigning them special names. It would seem preferable to apply the appropriate prefix, as has already long been done in the case of nickel skutterudite for the high nickel, high iron or high nickel and iron varieties.

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EFFECT OF MUCIN ON INFLUENZA VIRUS INFECTION IN HAMSTERS[1]

IN a study of factors which decrease the resistance of experimental animals to virus respiratory infections, the effect of the intratracheal inoculation of hamsters (*Cricetus auratus*) with influenza A virus in mucin has been determined.

The hamster was selected as the test animal because it appeared, from Taylor's work,[2] to have a limited susceptibility to this virus, as evidenced by failure to develop gross lesions. Mucin was used, since it has been shown to lower resistance to bacterial infections;[3] further, the possible role of mucous secretions in decreasing resistance to infections of the respiratory tract in general has been the subject of several papers by our group.[4,5,6]

METHOD

The PR-8 strain of influenza A virus[7] was main-

[1] This work was aided by a grant from The Kresge Foundation.

[2] R. M. Taylor, *Proc. Soc. Exp. Biol. and Med.*, 43: 541, 1940.

[3] W. J. Nungester, A. A. Wolf and L. F. Jourdonais, *Proc. Soc. Exp. Biol. and Med.*, 30: 120, 1932.

[4] W. J. Nungester and L. F. Jourdonais, *Jour. Infect. Dis.*, 59: 258, 1936.

[5] W. J. Nungester and R. G. Klepser, *Jour. Infect. Dis.*, 63: 94, 1938.

[6] W. J. Nungester, R. G. Klepser and A. H. Kempf, *Jour. Infect. Dis.*, in press.

[7] Obtained through the courtesy of Dr. Thomas Francis, Jr.

tained by mouse passage, and 0.1 ml of a 1 per cent. suspension of infected mouse lung in mucin or physiological saline was the inoculum used. The hamsters were two to six months old. Sterile 5 per cent. gastric mucin suspensions were prepared according to a technique previously described,[4] and also by a method to be published in a subsequent paper. Both preparations were satisfactory.

The hamsters were anesthetized by the intraperitoneal injection of Nembutal. Since intratracheal inoculations through the mouth with the aid of a catheter were not satisfactory, the trachea was exposed and 0.1 ml of the virus suspension in mucin, or physiological saline, was injected with a 25-gauge needle. The skin was then sutured. In one experiment, six hamsters were injected with 0.1 ml of virus previously neutralized with inactivated rabbit influenza A antiserum.

The animals were sacrificed six to eight days after inoculation, the lungs were removed, and gross pathological changes observed. The data from a few animals with concomitant bacterial infections, as determined by positive cultures on blood agar, were not included.

RESULTS

The results summarized in Table 1 indicate that when influenza A virus was suspended in sterile mucin, and injected intratracheally in hamsters, gross lung lesions developed which were similar to those seen in the lungs of mice infected with this strain of influenza virus. Since the incidence and extent of the lesions were markedly reduced, using an inoculum of mucin and influenza A virus neutralized with specific antiserum, it may be concluded that these results were not due to other viruses or bacteria present as contaminants. It should be noted that evidence of consolidation, however slight, is recorded in the table as a gross lesion. This may direct some unwarranted attention to the occurrence of lesions in animals inoculated with mucin alone, or with neutralized virus and mucin, since the lesions in these two groups of animals were small.

TABLE 1

THE USE OF MUCIN IN THE PRODUCTION OF INFLUENZA VIRUS PNEUMONIA IN HAMSTERS

Inoculum	Number of hamsters	Per cent. with gross lesions	Average number of lobes involved	Extent of lesion
Virus in saline ..	11	9	3	+
Virus in mucin ..	31	71	4	+++
Mucin	20	25	1	+
Neutralized virus in mucin	6	33	2	+ to ++

(+) Smallest visible lesion to 25 per cent. involvement, (++) 25 to 50 per cent. involvement, (+++) 50 to 75 per cent. involvement, of each infected lobe.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE PREPARATION OF SODIUM PYRUVATE

PYRUVIC acid, because of its important position in the intermediary metabolism of proteins and carbohydrates, is being used with increasing frequency in physiologic experimentation, including studies on tumor metabolism. The stable sodium salt is the most desirable form for handling this compound. However, the usual method of preparation of sodium pyruvate,[1] involving a very sensitive neutralization of small amounts of freshly distilled aqueous pyruvic acid with dilute alkali, is tedious and bothersome. The yield is often poor and contaminated with brown resinous condensation products.

If the neutralization of pyruvic acid is carried out in alcohol, sodium pyruvate, because of its insolubility, will be removed from the reaction as soon as formed. The following simple method, which is based on this fact, permits rapid preparation of any desired amount of the salt. Dissolve 10 ml (12.7 gm) of pyruvic acid (Eastman-498) in 100 ml of alcohol. Redistillation is unnecessary. (A sample which had stood in the laboratory for some weeks and was quite yellow yielded sodium pyruvate which appeared as good as the sample whose analysis is reported below.)

Sodium pyruvate: $CH_3 \cdot CO \cdot COONa$

Calculated— C–32.71 per cent.; H–2.75 per cent.; Na–20.90 per cent.

Found— C– 32.63 per cent.; H– 2.96 per cent.; Na– 21.15 per cent.
C– 32.58 per cent.; H– 2.71 per cent.; Na– 20.83 per cent.

The acid is neutralized with alcoholic alkali made by diluting 10 ml of saturated sodium hydroxide with 100 ml of alcohol. The neutralization may be carried out at room temperature and does not have to be exact, for excess alkali is without immediate effect. (A preparation which had been considerably over-titrated showed only traces of yellow condensation products after standing 24 hours.) The sodium pyruvate, which precipitates as a white amorphous powder, is

[1] E. M. Case, *Biochem. Jour.*, 26, 753: 1932.

washed with alcohol and ether, and dried in a vacuum desiccator. Yield, 13.5 gms (85 per cent. of theoretical). Upon recrystallization from 80 per cent. alcohol glistening white plate-like crystals are obtained. No impurities were detected by polarographic analysis by Dr. R. J. Winzler.

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DRAWING LAMP FOR CAMERA LUCIDA

ONE of the main difficulties in drawing microscopic objects by the aid of a camera lucida is that of balancing the brilliance of light on the drawing paper with that coming through the microscope. It is generally done by laboriously pushing a lamp around the table or by neutral filters which dim the image.

By the simple expedient of putting a variable resistor in series with the lamp, quick and easy control of illumination on the paper is accomplished. Such a scheme is shown diagrammatically in Figure 1, which indicates the connections of the three electrical components, power plug (P), rheostat (R) and lamp socket (S). In wiring the only caution to observe is that the rheostat turns *clockwise* to increase brightness of the bulb.

On the right in Fig. 2 is an easily made unit adaptable to any set-up of the microscope. It consists of a 3″ × 4″ × 5″ iron shield box (B) to hold the rheostat (R) and act as a base for the 15″ gooseneck tubing (T) and socket (S). These boxes have two loose sides which are held in place by screws in each corner. On the side used as a top are mounted the rheostat and a tripod fixture known as a "crowfoot" into which screws the flexible tubing. On the inside of the bottom plate a pound or so of sheet lead is bolted for

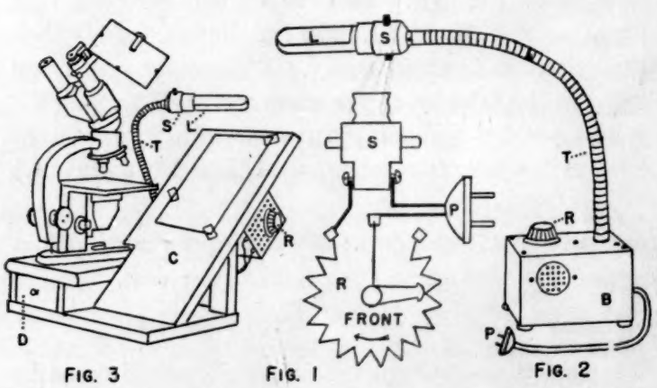

FIG. 3 FIG. 1 FIG. 2

ballast, and ventilation holes are punched in the sides and covered by metal screening. The socket has a push-through switch and holds a tubular half-silvered showcase bulb (L). As this bulb is small it causes less interference with the camera lucida mirror than the usual bulb and reflector of a desk lamp. The Mazda bulbs are made in two ratings 25 and 40 watt (120 volt). The 25-watt bulb is entirely adequate and the rheostat should be 500 ohms for proper dimming, and as it carries a maximum current of 0.25 amps. it must be in the 50 watt class.

For one who uses a binocular microscope and has much drawing to do it is well worth while to build the wooden frame with drawing board (C) and microscope stand in one piece (Fig. 3) which assures that all drawings are at the same magnification; paper can be conveniently fastened down by Scotch tape. The part of the camera lucida which fastens to the microscope is left in place and only the mirror removed so a dust cover can be put over the instrument at night. The gooseneck tubing (T) is fastened by the crowfoot directly to the frame, and the rheostat (R), enclosed by a guard of perforated metal, is mounted conveniently for the drawing hand. The board (C) must be inclined from the horizontal exactly as are the ocular tubes from the vertical to avoid distortion.

It will be noticed that the microscope is slightly elevated by the frame. We have found that this puts the eyepieces in a more comfortable position which eliminates some of the "stooping" associated with microscope work, and Dr. D. H. Linder has taken advantage of this space to insert a small drawer (D) in which to keep lens paper, micrometer-ocular, etc. This stand and lamp, as shown in Fig. 3, will surprise with its convenience anyone used to changing to the monocular, assembling the camera lucida and drawing on a flat table with daylight or an ordinary desk lamp. It is so easy to use that many objects can be sketched "when you see them" rather than waiting until some later time or being mislaid or neglected completely.

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